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Abstract: *This study developed a web-based payment tracking system for boarding houses near Caraga State University in Barangay Ampayon, Butuan City. It was designed to improve rental transactions and resolve issues arising from manual processes such as delayed payments, poor communication, and lack of transparency due to reliance on notes and verbal reminders. The system enables landlords to create bills, track payments, and monitor tenant balances, while tenants can view billing information, payment history, and receive real-time updates. Emphasis was placed on user-friendly design and a smooth user experience. The system was evaluated using the ISO/IEC 25010 software quality model, focusing on functional suitability, usability, performance efficiency, and reliability. Results show that the system effectively simplifies payment tracking, reduces manual work, and improves communication between landlords and tenants. Overall, the system offers a reliable and scalable solution for automating the management of boarding house rentals in university areas.*

Keywords: Payment Tracking; Boarding House Management; Rental Automation; ISO/IEC 25010; Digital rent management;

1. INTRODUCTION

Universities significantly impact academics and science, so their location is critical. When campuses are placed in rural areas, they often attract student residents, leading to studentification and possible social segregation from non-students [1]. Studentification around university campuses increases real estate demand as more housing and amenities are needed to accommodate students. Their choice of residence is influenced by factors such as distance to campus and transport stations, rental costs, monthly budget, and the availability of amenities and services [2].

In the Philippines, boarding houses have traditionally played a vital role in residential landscape, particularly for students and young professionals in need of low-cost, short-term lodging close to educational institutions or workplaces. Their affordability and adaptability make them a practical substitute for conventional housing options. For students, boarding houses provide more than just shelter. They contribute to academic success and personal well-being. Their cost-effectiveness and convenient locations are especially beneficial for those coming from distant provinces. Despite these advantages, many boarding houses encounter operational issues that affect their overall efficiency.

One significant challenge in managing boarding house rentals is the absence of an effective system for handling financial transactions. Relying on manual tracking often results in errors, delays, and conflicts. As highlighted by [3], collecting rent and utility payments manually can lead to mismanagement and disputes due to lost or overlooked payments. Tenants frequently face difficulties keeping track of their dues, while landlords struggle to maintain accurate and up-to-date financial records. Without automated systems, payment delays are common, and both landlords and tenants find it challenging to monitor balances and payment history. Additionally, research by Negara et al. [4] shows that manual bookkeeping in boarding houses leads to inconsistencies and weak financial control. The lack of digital records hinders auditing and tracking of cash flow, resulting in inefficient use of time that could be better spent on other administrative tasks.

These problems are especially prevalent among boarding houses in Barangay Ampayon, Butuan City, Philippines, an area that hosts a major university, a science high school, and multiple government offices. Both tenants and landlords have acknowledged that relying on handwritten records, cash transactions, and verbal agreements leads to inefficiencies and financial uncertainty. This underscores the pressing need for automated payment and record-keeping systems. In response to these challenges, the researchers aim to create a web-based Boarding House Payment Tracking System to automate key transactions, such as online payments. Specifically, the study aims to achieve the following:

a. To design and develop an intuitive web-based user-friendly interfaces that offer an integrated platform for rent collection, billing, and transaction monitoring.

b. To evaluate the developed system using the ISO 20510 software quality standards covering functionality suitability, performance efficiency, compatibility, usability, reliability, and security in order to assess its level of ISO compliance.

c. The formulate recommendations for further enhancement of the developed system.

The system seeks to enhance transparency, minimize errors, and alleviate administrative workload, as supported by Habib and Meryam [5]. Landlords can efficiently oversee financial operations and generate reports, while tenants gain convenient access to their payment status, promoting accountability. Ultimately,

this system has the potential to modernize financial management for boarding houses in Barangay Ampayon, Butuan City, by providing a dependable and transparent solution for both landlords and tenants.

2. LITERATURE REVIEW

Operating a boarding house can be highly profitable, especially near university campuses where student housing demand is constant. However, managing finances and tenant information poses significant challenges. Multiple studies highlight common issues faced by boarding house owners due to manual systems. The research by Eltivia et al. [6] emphasizes the complexity of overseeing costs, bills, and assets, making the process demanding. According to Monterve et al. [7], tasks like verifying vacancies, entering tenant data, and financial record-keeping are time-consuming and prone to errors. Kurnia, et.al [8] added that manual systems lack payment reminders and an effective complaint resolution process. Golande, et. al. [9] further note that paperwork-heavy processes result in inconsistencies, data loss, and inefficiency in updating records. Wibawa et al. [10] also stress that these problems worsen for owners managing numerous rooms or properties, making traditional methods unsustainable and unreliable for large-scale operations.

However, the availability of automated payment tracking improves financial management by ensuring timely payments, reducing manual errors, and enhancing cash flow for these boarding houses. These systems save time, increase accuracy, and provide insight into revenue—making them highly beneficial for accommodation providers. The effective payment tracking is crucial for maintaining financial stability and efficient business operations. FasterCapital [11] highlights its role in monitoring outstanding balances, due dates, and preventing late payments, thereby supporting healthy cash flow. Baibhav et al. [12] note that managing invoices and collecting payments is often challenging, necessitating systems that can streamline tracking and provide revenue insights. Mustapa et al. [13] further emphasize the administrative difficulties caused by errors in payment records, delays, and inefficient history verification. Collectively, these studies point to a clear need for improved payment tracking systems, especially in accommodation settings like boarding houses, to address these ongoing challenges.

Additionally, the utilization of online payment systems offers convenience, speed, and security in financial transactions. Kanimozhi & Mythili [14] and Veena, et.al [15] emphasize that digital payments reduce the need for physical banking and cash handling.

3. METHODS

3.1 Software Development Methodology

Figure 1.0 shows the model for the researchers to use, that is, the Agile method. Agile methodology refers to a management framework for managing projects that classifies projects into several dynamic stages, or more commonly referred to as sprints [16]. The method assisted in lowering risks, ensuring quality at every release, enabling higher customer satisfaction, having tighter project control, and responding efficiently to changes.

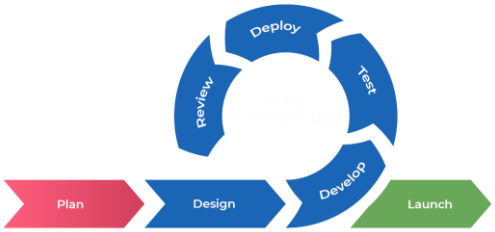

Fig 1.0 Agile Methodology

3.2 Use Case Diagram

Figure 2.0 shows the interactions between the main actors and the Web-Based Boarding House Payment Tracking System. The diagram is a high-level representation of the functionalities of the system and the roles played by every actor in the system.

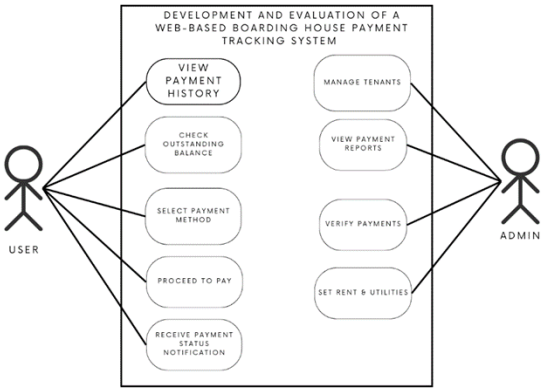

Fig. 2.0 Use Case Diagram

The main actors in the system are:

Tenant (User): This user interact with the system to view payment history, view outstanding balance, select payment medium (GCash), and proceed with payments via PayMongo. Further, tenants also receive real-time notification of payment status for update transaction.

Owner (Admin): Owner manages tenants, payment confirmation, finance reporting, and rent & utilities configuration. They confirm payments received in PayMongo and generate monthly reports of income and pending balances for financial tracking.

The applications outlined in the diagram define the fundamental operations of the system like payment processing, transaction tracking, reporting, and tenant management to ensure that it has a well-streamlined and efficient approach for boarding house payment tracking.

3.2 System Flowchart

Figure 3.0 illustrates the system flowchart of the Web-Based Boarding House Payment Tracking System to show the linear interactions between users and administrators. The process begins with user login and dictates access either to the Admin Dashboard or Tenant Dashboard. Administrators are able to update tenants, verify payments, view reports, and charge rent and utilities, while tenants are able to view past due balances, view payment history, select how to pay, proceed with the payment, and view payment statuses. This systematic flow helps in proper management of rent as well as

provides a hassle-free experience for both the landlord and tenants.

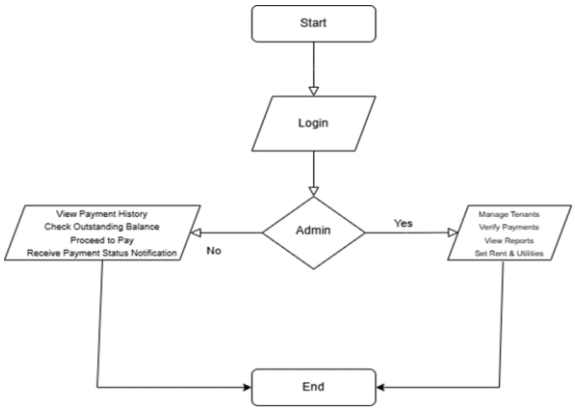

Fig. 3.0 System Flowchart

3.3 System Architecture

The design and development of the system apply a combination of modern and cutting-edge web technologies aimed at delivering a seamless and intuitive experience for its users. This includes boarding house owners, tenants, and administrators, who all benefit from a highly responsive, scalable, and efficient platform. The system leverages a full-stack development approach utilizing Vue.js for dynamic user interfaces, Vuetify for elegant and consistent UI components, and Supabase as the backend service that provides authentication, real-time database updates, and RESTful APIs.

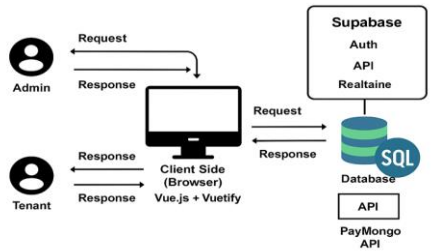

Fig. 4.0 System Architecture

By integrating these technologies, the system ensures real-time processing of data, enabling users to access up-to-date information instantly, whether it's for tracking payments, viewing tenant details, or managing room assignments. Furthermore, the integration with PayMongo allows for secure and streamlined online payments, reducing manual processing and improving the overall efficiency of financial transactions within the boarding house environment.

This architecture does not only promote ease of use but also ensures that the system is accessible across multiple devices and platforms. Through its modern web-based approach, the system provides an error-free, reliable, and satisfying user experience tailored to meet the needs of all stakeholders involved in boarding house operations.

3.4 Entity Relationship Diagram

Figure 5.0 displays the Entity-Relationship Diagram (ERD) for the Web-Based Boarding House Payment Tracking System, describing users, rooms, bed assignments, invoices, payments, reports, and system settings and their relationships. The system effectively handles tenant assignments, payment tracking, and financial reports with accurate calculation of rents and utilities while enabling administrators to change rates and track revenue.

Fig. 5.0 Entity Relationship Diagram

3.8 System Evaluation

System evaluation was conducted using the ISO/IEC 25010 standard, which outlines eight key quality characteristics for assessing software product quality. The ISO 25010 questionnaire was structured according to these characteristics, with each section containing specific indicators to measure how well the system met each criterion. To ensure a thorough and credible evaluation, the questionnaire was answered by five (5) IT experts, whose technical expertise and professional judgment provided valuable insights into the system's strengths and areas for improvement. This approach allowed for a comprehensive assessment of the system's overall quality.

3.5 Research Instrument

The study utilized a 5-point Likert scale survey to gather data on the financial management practices and issues experienced by boarding house owners and tenants. The first part of the survey focused on current methods used to manage payments, such as rent and utilities, and whether manual or digital tools were used. The second part assessed challenges related to recordkeeping, payment monitoring, communication, and financial transparency, with respondents indicating their level of agreement to various statements. The questionnaire was based on the framework by Anggaco et al. [17] to ensure content and construct validity, aligning with real-world issues in boarding house management. Additionally, an ISO/IEC 25010-based questionnaire was used to evaluate the system's software quality across eight key attributes, with responses provided by an IT expert to ensure a thorough technical assessment.

3.6 Data Collection Process

Data collection for this study involved gathering appropriate information on boarding houses in Brgy. Ampayon, Butuan City. The data was gathered through the evaluation of the developed system with stakeholders like boarding house owners and tenants to understand their preferences, needs, and difficulties regarding the financial aspects of the boarding house.

3.7 Data Analysis

To examine the data gathered by the survey for research, the study employed a 5-point and 4-point Likert scale. The Likert scale is the most frequent instrument employed in quantitative research for measuring respondents' feelings, opinions, or experiences. According to Bhandari & Nikolopoulo [13], "it consists of a statement or a question, followed by a series of five or seven answer statements." Respondents choose the option that best corresponds with how they feel about the statement or question".

The points used for 5-point likert scale were: 5 points = Strongly Agree, 4 points = Agree, 3 points = Neutral, 2 points = Disagree, and 1 point = Strongly Disagree while the 4-point likert scale used 4 points = Very Functional/usable, 3 points = Functional/Usable, 2 = Moderately Functional/Usable, 1 = Poorly Functional/Usable.

For the 5-point scale, the mean scores were interpreted as follows (See Table1.0):

Table 1.0 Interpretation of Range of the Weighted Mean

Range of the Weighted Mean	Interpretation
4.51 – 5.00	Very Great Extent (as a computer User)
3.51 – 4.50	Great Extent (as a computer User)
2.51 – 3.50	Moderate Extent (as a computer User)
1.51 – 2.50	Low Extent (as a computer User)
1.50 and below	Very Low Extent (as a computer User)

4. RESULTS AND DISCUSSION

4.1 The User Interfaces of a Web-Based Boarding House Payment Tracking System

The user interface design of the Web-Based Boarding House Payment Tracking System caters to both the tenant and administration perspective. It provided graphical overviews of the important pages like the dashboards, payments and bills, room allocation, and system settings. The interface was developed with Vue.js and Vuetify, with a clean and responsive Material Design-based layout to provide a smooth and intuitive user experience. Every screenshot is the live design of the system, showing how users engaged with its features in a real-world and user-friendly setting.

4.1.1 The Tenant's Interfaces

4.1.1.1 Login and Registration Interface

This interface offered a secure way for tenants to log in to the system through a login form, authenticating their credentials. The registration portion collects the required user information to create a tenant account. Both interfaces have a minimalist and responsive design so that simplicity and usability are preserved irrespective of the devices.

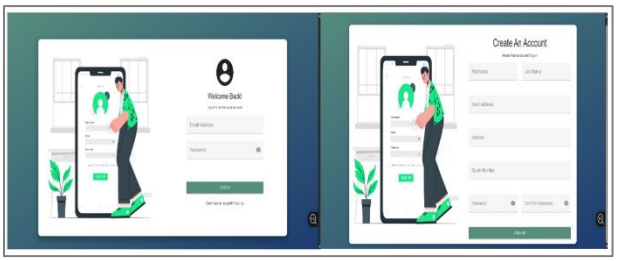

Figure 6.0 Login and Registration UI

4.1.1.2 Dashboard Overview

The overview of outstanding balances, due dates, and built-in alerts that notify tenants of important events. There is also a transaction history section built into the dashboard, providing a comprehensive list of previous payments. The design promotes user-friendly simplicity and ease of navigation for end users.

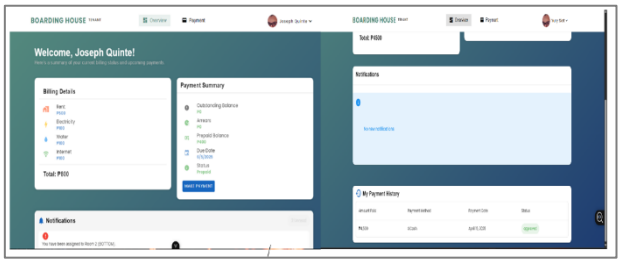

Figure 7.0 Dashboard Overview

4.1.1.3 Billing and Payment Page

This page demonstrates a breakdown of the billing information of the tenant in detail, with payments for rent, electricity, water, and internet. Tenants have the option to proceed with payments through an online payment gateway integrated, PayMongo, which accommodates platforms such as GCash. Payment statuses are updated in real time after a successful transaction. The interface is transparent and provides for a smooth payment process.

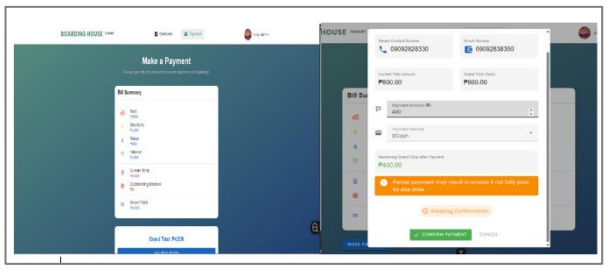

Figure 8.0 Tenant's Payment Page

4.1.2 The Administrator's Interfaces

4.1.2.1 The Administrator's Login Page

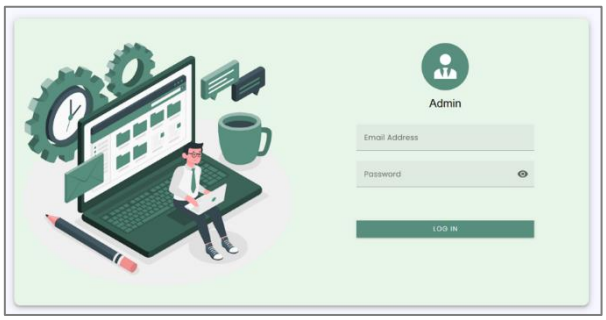

Figure 9.0 Administrator's Login Page

The administrator login page offers a secure entry for authorized staff. It authenticates login credentials and uses role-based access control to safeguard sensitive financial and administrative information.

4.1.2.2 The Administrator's Dashboard

The administrative dashboard offers an overview of system analytics and the most important financial indicators. Total revenue, payment confirmed and awaiting confirmation, as well as statistics on the number of tenants occupied, are represented. Interactive statistics and summaries are used to boost administrative monitoring and decision-making. All data is synchronized in real time to ensure its accuracy.¥

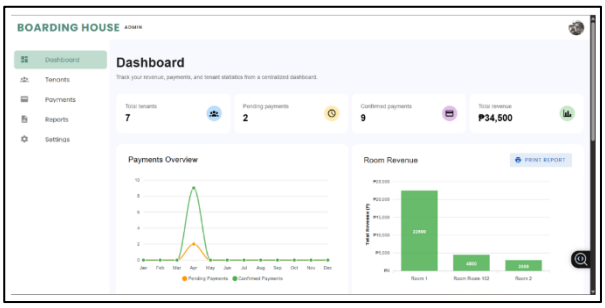

Figure 10.0 Administrator's Dashboard

4.1.2.3 The Tenant Management and Ledger Page

This section enables the administrator to view, manage, and update tenant records. The ledger presents a chronological record of all the financial activity for each tenant, such as billed amounts, payments, and outstanding balances. This part features the ability to print individual tenant ledgers for reference and record-keeping purposes

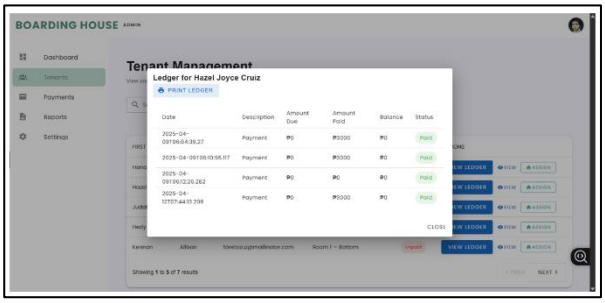

Figure 11.0 Tenant's Ledger Component

4.1.2.4 Payment Monitoring Page

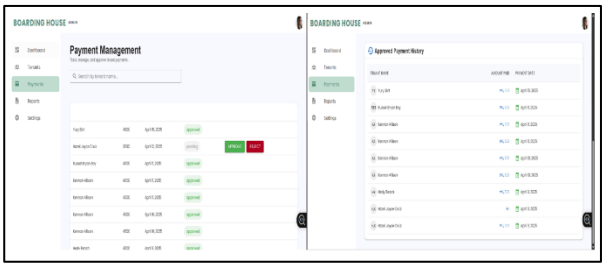

Figure 12. 0 Tenant's Payment Monitoring Page

This module provides a complete list of payment submissions by the tenants. Each entry contains the name of the tenant, amount paid, date and time of transaction, and payment status. Payment can be approved or rejected by the administrator and their status modified accordingly. An option to print is available to take physical copies of all transactions.

4.1.2.5 Report Page

The reporting module facilitates the production of different financial and operational reports, including monthly income reports, overdue payments reports, and tenant activity records. Each report can be printed for filing and auditing purposes to enhance administrative transparency and accountability.

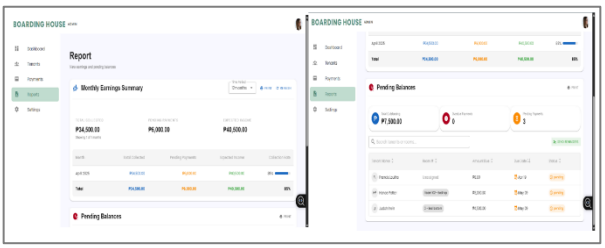

Figure 13.0 The Reporting Page

5.2 The Evaluation of the Developed System Using ISO/IEC 25010 Software Quality Standards

As presented in Table 2.0, the developed system was assessed against ISO/IEC 25010 which defines eight software quality characteristics. The results as shown as follows:

A. Functional Suitability
The system scored 3.17 (Great Extent), indicating that it met the requirements in terms of completeness, correctness, and appropriateness of functionalities.

B. Performance Efficiency
With an overall mean of 2.83 (Moderate Extent), the system showed acceptable response times and capacity, although improvements were recommended for better resource utilization.

C. Compatibility
Scoring 3.30 (Moderate Extent), the system demonstrated effective interoperability across devices, with some potential for enhancement in co-existence with other systems.

D. Usability
Usability was rated the highest, with a mean score of 3.91 (Great Extent). Participants appreciated the learnability, operability, user interface design, and accessibility of the system.

E. Reliability
Reliability received a moderate score of 2.5 (Moderate Extent). While availability and maturity were acceptable, fault tolerance and recoverability required improvement.

F. Security
The system was rated 3.24 (Moderate Extent), meeting standards for confidentiality, integrity, accountability, and authentication.

G. Maintainability
Maintainability had a score of 2.64 (Moderate Extent), indicating areas for improvement in modularity, analyzability, and modifiability to support long-term maintenance.

H. Portability
With a score of 2.6 (Moderate Extent), the system showed basic adaptability and install ability but needs enhancement for broader deployment scenarios.

Table 2.0 Overall Assessment of the Participants on the Compliance of the Developed System to ISO 25010 Software Quality Standards

Criteria	WM	Descriptive Interpretation
Functional Suitability	3.17	Great Extent
Performance Efficiency	2.83	Moderate Extent
Compatibility	3.30	Moderate Extent
Usability	3.91	Great Extent
Reliability	2.50	Moderate Extent
Security	3.24	Moderate Extent
Maintainability	2.64	Moderate Extent
Portability	2.60	Moderate Extent
Overall Mean	**3.02**	**Moderate Extent**

The overall average of **3.02** indicates overall compliance with software quality standards. The system performed well in usability, whereas reliability, maintainability, and portability were noted as areas to be further improved.

5.3 The Suggestions to Further Enhanced the Developed System

The evaluation of the Web-Based Boarding House Payment Tracking System by both the tenants, boarding house owners, and IT experts revealed that the system is functional and promising, particularly in its approach to handling rental transactions and payment management.

The tenants and boarding house owners described the system as visually appealing and effective in covering essential features, especially with the use of graphs and summary reports that enhanced data understanding and usability. However, they suggested improvements in the display of room availability and the inclusion of room photos for better user engagement.

On the other hand, IT experts acknowledged the system's functionality but highlighted the need for enhancements on the tenant-side experience. They observed issues related to user interface consistency, navigation flow, and mobile responsiveness. To address these, they recommended refining the tenant UI for smoother navigation, and updating the design to align with modern web standards. They also emphasized the importance of ensuring full responsiveness across all devices and suggested the addition of real-time notifications for better user engagement. Overall, while the system was recognized as functional and well-developed, the feedback pointed to key areas for improvement to further enhance usability and interactivity.

2. SUMMARY AND CONCLUSION

The development of the Web-Based Boarding House Payment Tracking System has successfully addressed the key challenges associated with traditional, manual payment tracking methods in boarding houses. By automating the billing process, integrating real-time data synchronization, and enabling digital payment through GCash, the system significantly improves operational efficiency, financial transparency, and convenience for both tenants and boarding house owners.

The system evaluation conducted with a boarding house owner revealed a high level of satisfaction with the system's functionality, ease of use, and reliability. Furthermore, an evaluation conducted using the ISO/IEC 25010 software quality model by five IT experts and one end user confirmed the system's strong performance in critical areas such as functional suitability, usability, and performance efficiency. These results validate the system's readiness and effectiveness as a modern solution tailored to the needs of small- to medium-scale boarding house operations.

Overall, the system offers a practical, scalable, and user-friendly platform that enhances the entire payment management experience, making it a valuable tool for both administrators and tenants in Barangay Ampayon, Butuan City, and beyond.

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